



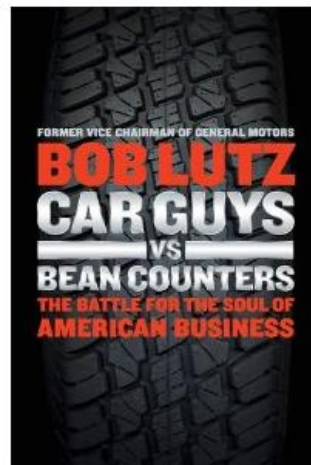
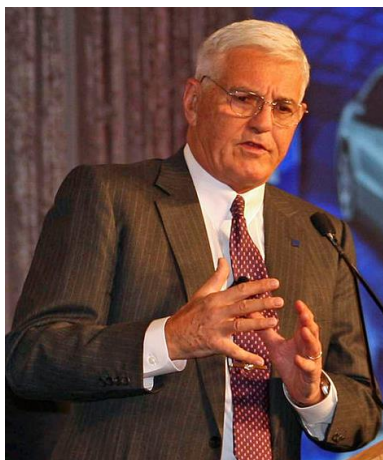
Laxenburg, 18 June, 2014

A New Technological Revolution Needed: A Five-Fold Increase of Resource Productivity

Prof. Ernst Ulrich von Weizsäcker



First a word on the role of technology ...



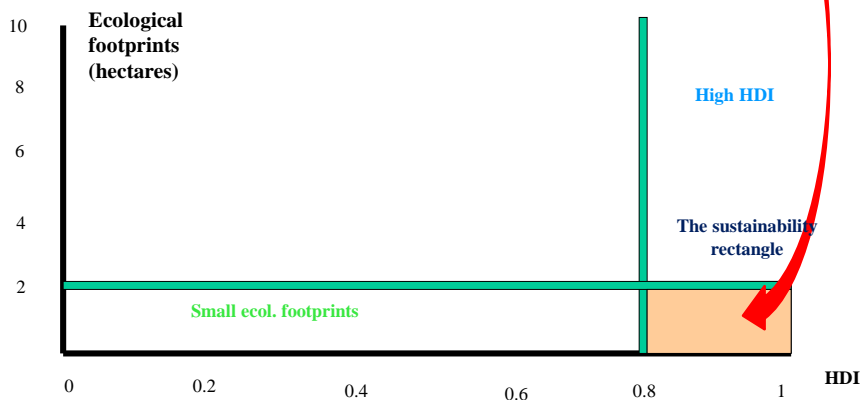
„To get the US economy growing again, we need to fire the MBA’s and let engineers run the show“ (cf. Rana Foroohar, TIME July 18, 2011, p 16)

Second, a word on sustainable development.

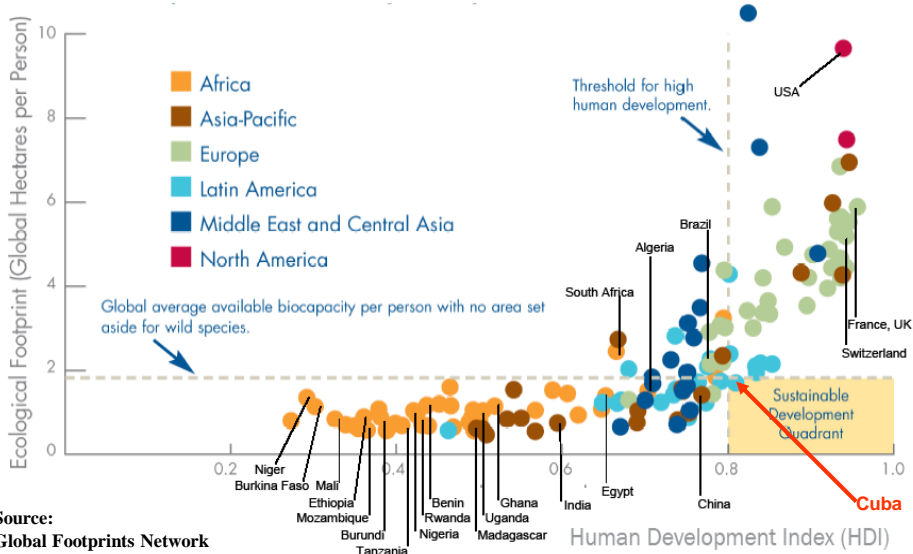
In the UN discussions on the SDG's, sustainable development has come to mean un-interrupted growth and development.

I am afraid that this definition itself is not sustainable.

Using footprints to define sustainable development:
small ecological footprints
and a high Human Development Index (HDI)



Only one country is sustainable. And the UN's SDG philosophy makes things much worse!

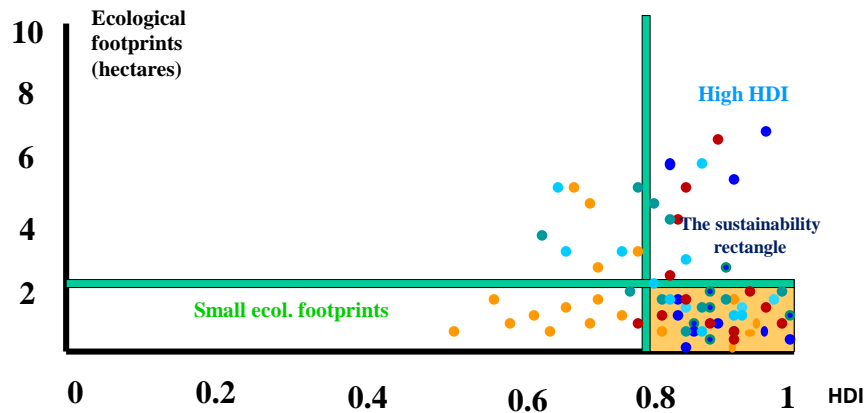


Source:
Global Footprints Network

**7 b people having footprints like US
Americans would need 5 planets Earth**



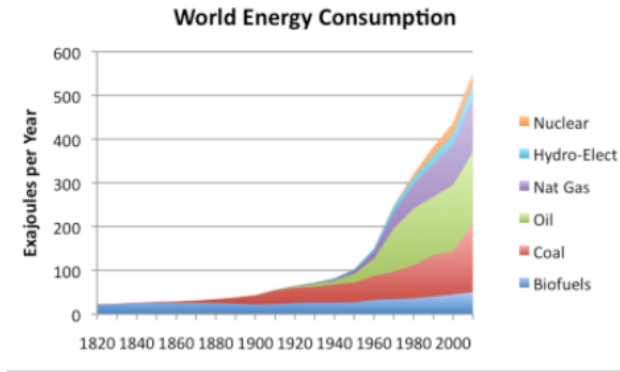
**A fivefold increase of resource productivity
could re-populate the sustainability rectangle!**



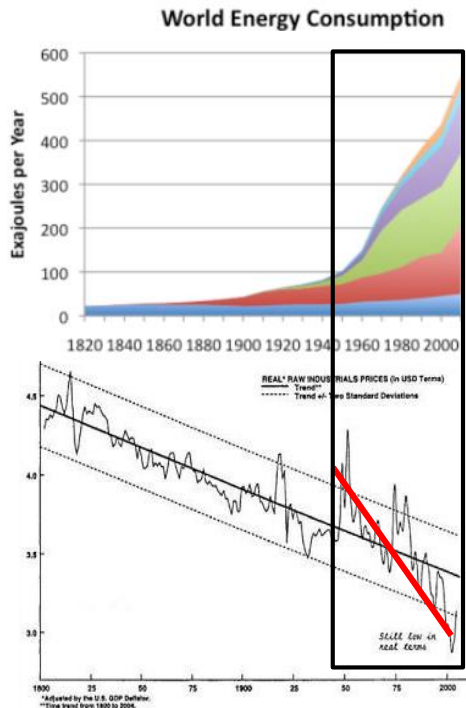
... and one planet Earth would do again!



**But current trends of energy consumption make that extremely unlikely.
What's the reason for that explosive growth?**



From Gail Tverberg's Blog „Our Finite World“, 2011



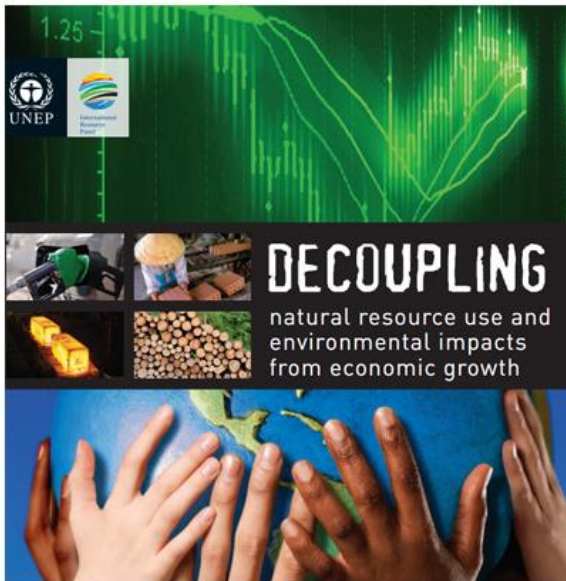
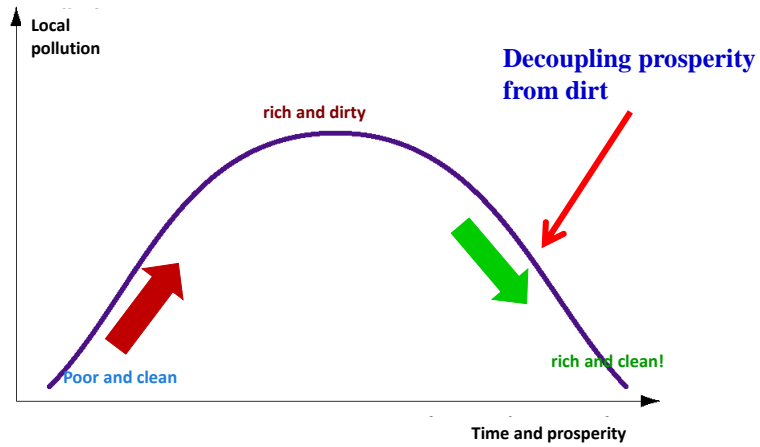
The decades of explosive growth of energy (and material) use were

...

the decades of rapidly falling commodity prices

Source: The Bank Credit Analyst, 2004

Our hope rests in the fabulous and benign Kuznets Curve of pollution! It has become the major paradigm of **Decoupling!**

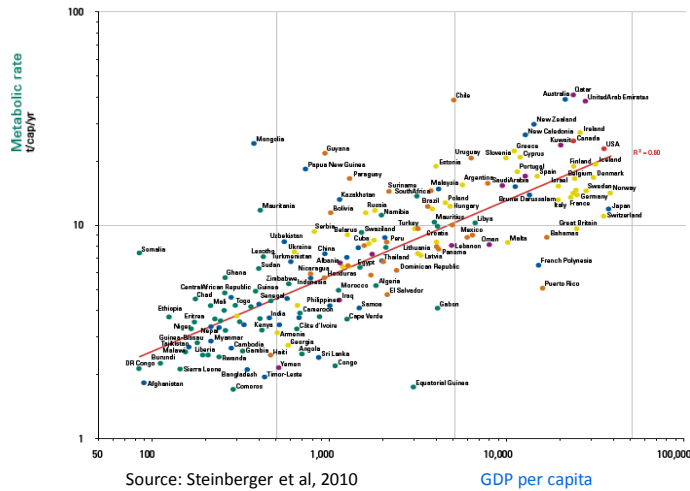


At the IRP

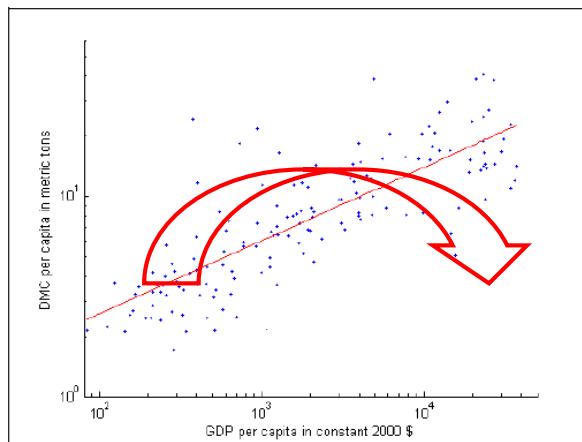


Decoupling is the core ambition.

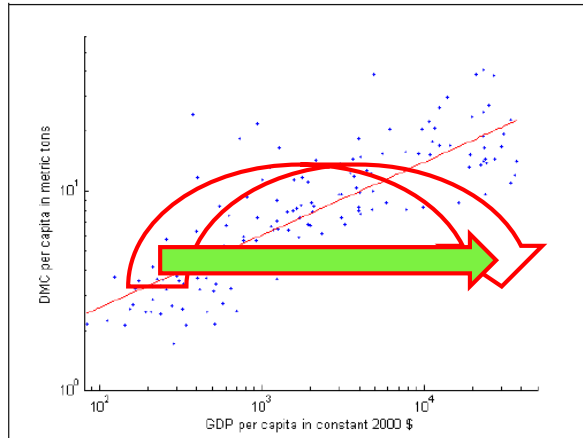
However, so far decoupling of GDP from resource use is not happening!



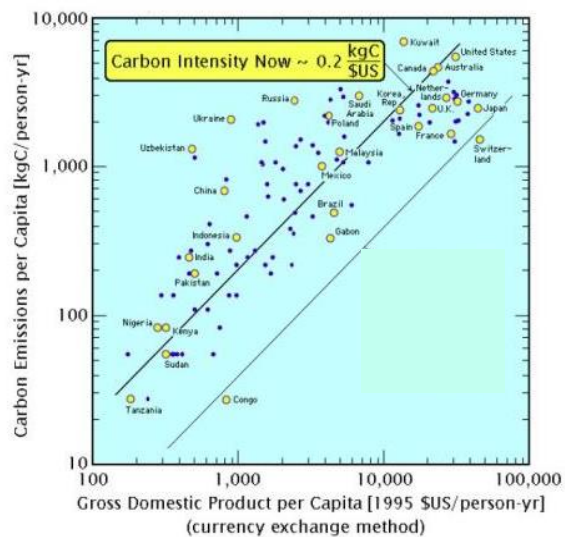
To make it happen, we have to create a Kuznets Curve for resource use.



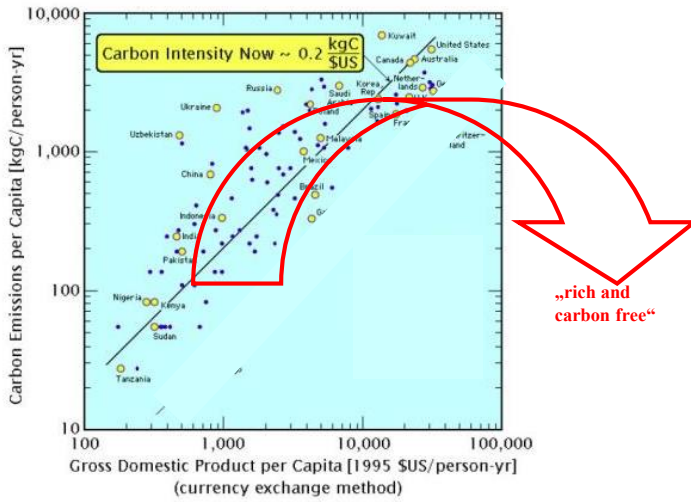
... and assist developing countries to tunnel through



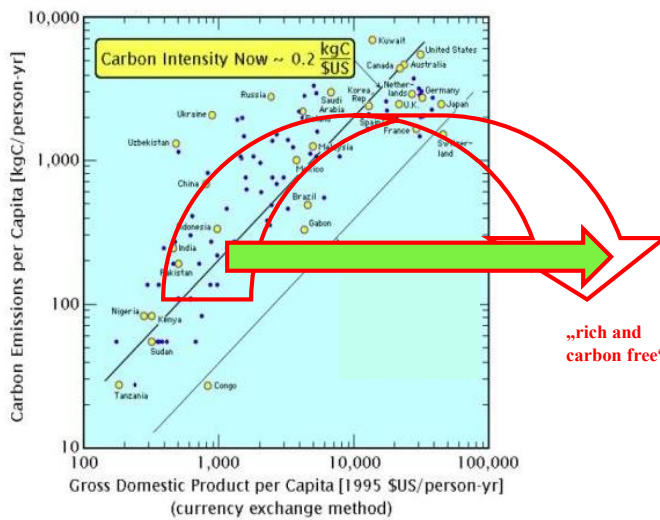
Very similar story for with CO₂ intensity, which also goes with GDP per capita



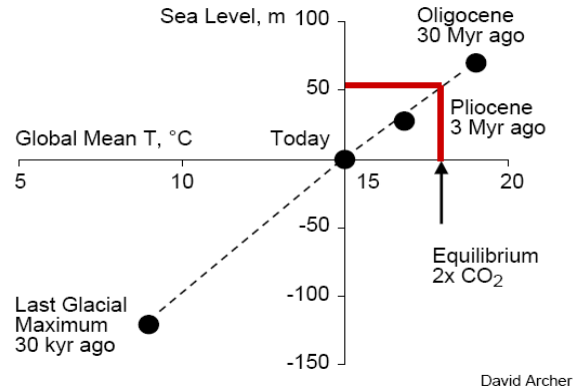
...and the hope for a „Kuznets Curve of decarbonization“.



...and to induce poorer countries tunneling through.



**It could become really urgent to stop global warming!
Close correlation between sea levels and temperature.
Doubling CO₂ concentrations could mean + 50 meters!!**

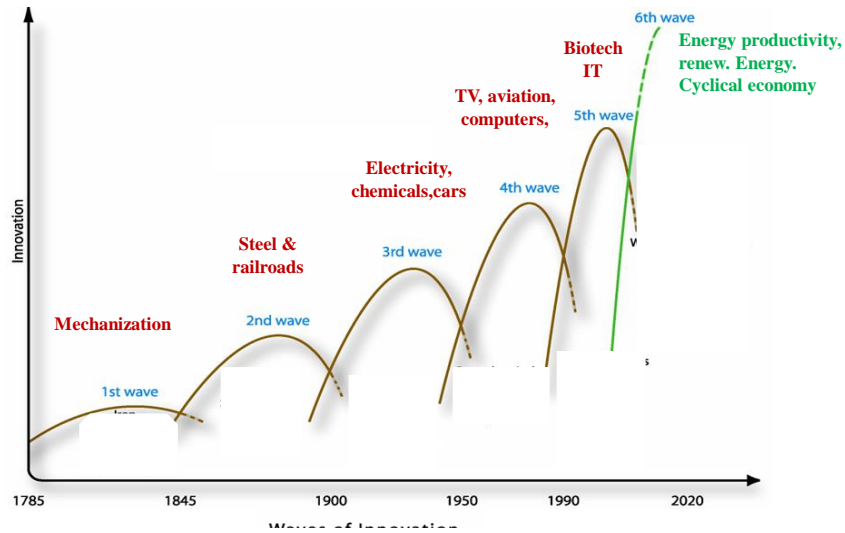


The difference in sea levels makes for an undesired difference of coast lines.



Source: Atlante Geografico Moderno. Mondadori, 1985

Ambitious efficiency increases means a **Green** Kondratiev Cycle, after five **brown** Cycles.



We are able to prove that a five-fold increase in resource productivity is *technologically available*.

People tend to believe that this is just a utopian dream. Well, let us then look at a surprising fact from physics...



**Imagine a bucket
of water of 10 kg
weight**

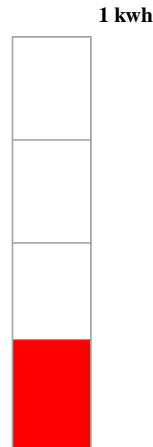
**How many
kilowatt-
hours**

**do you need to lift
it from sea level
to the top of
Mount Everest?**



**The answer is
stunning:
One quarter of a
kilowatthour!**

(knowing that one watt-second is one Joule or one Newton-meter; $\frac{1}{4}$ kwh is 900.000 watt-seconds)



General Electric thinks efficiency also means earning a lot of money.

1% gains in energy efficiency will yield \$200b in 15 years

\$30b gains (Aviation)



\$66bgains (Power)



\$63b gains (Health)

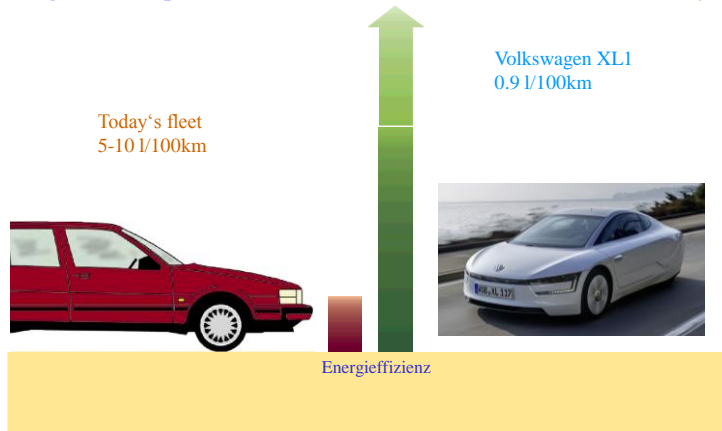


\$27b gains (Railways)



Source: Peter C. Evans and Marco Annunziata. 2012. Industrial Internet. General Electric

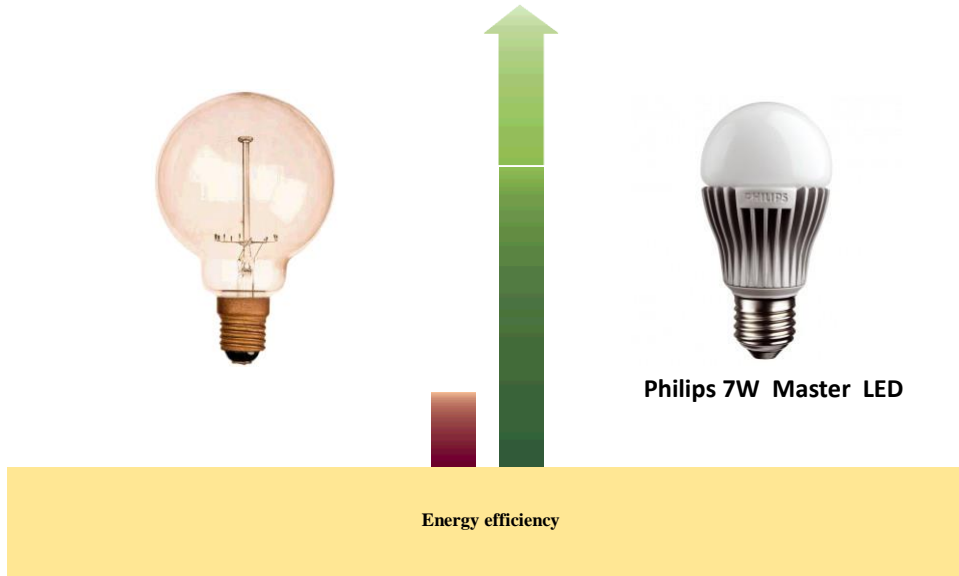
Let us run through some Factor Five examples.
Volkswagen's concept car XL1 is five times more fuel efficient than today's fleet



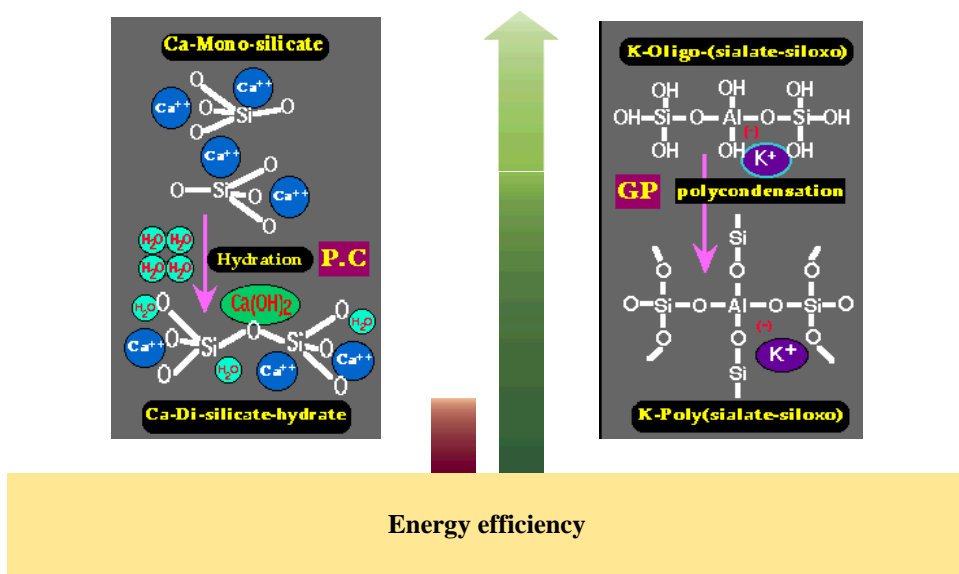
“Passive houses”: a factor of ten more heat efficient



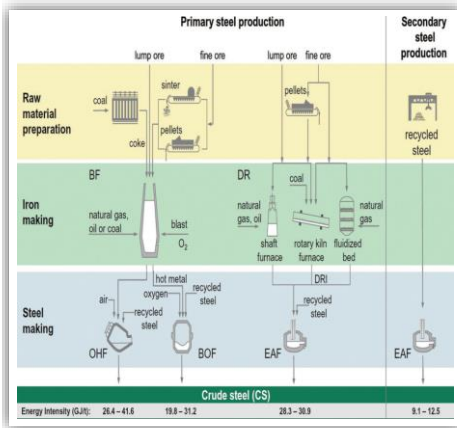
LED replacing incandescent bulbs: a factor of 10



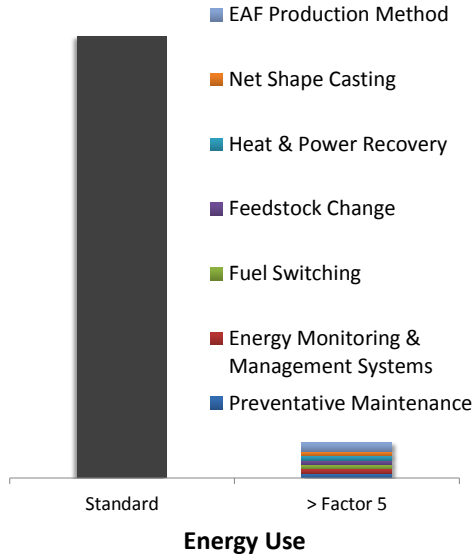
From Portland cement to geopolymer cement (e.g. fly ashes from coal power plants).



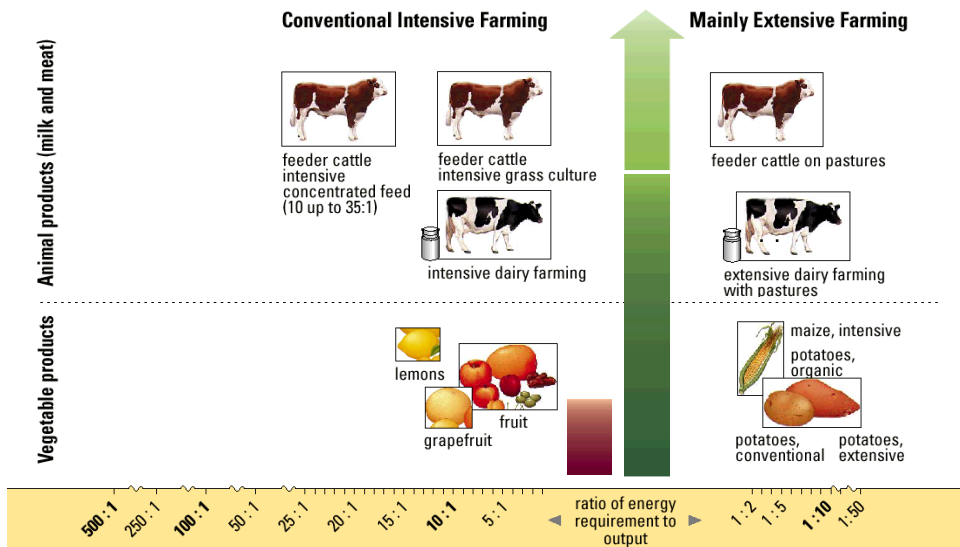
Steel



A factor of 3 already between basic oxygen furnace and electric arc furnace



A little less beef, organic farming, more local and seasonal food ...



From car-centered to human-centered cities

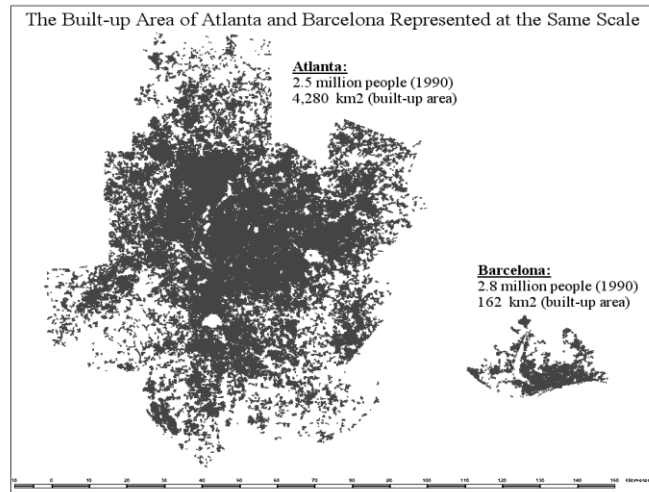


Atlanta, Georgia

Energy and space efficiency

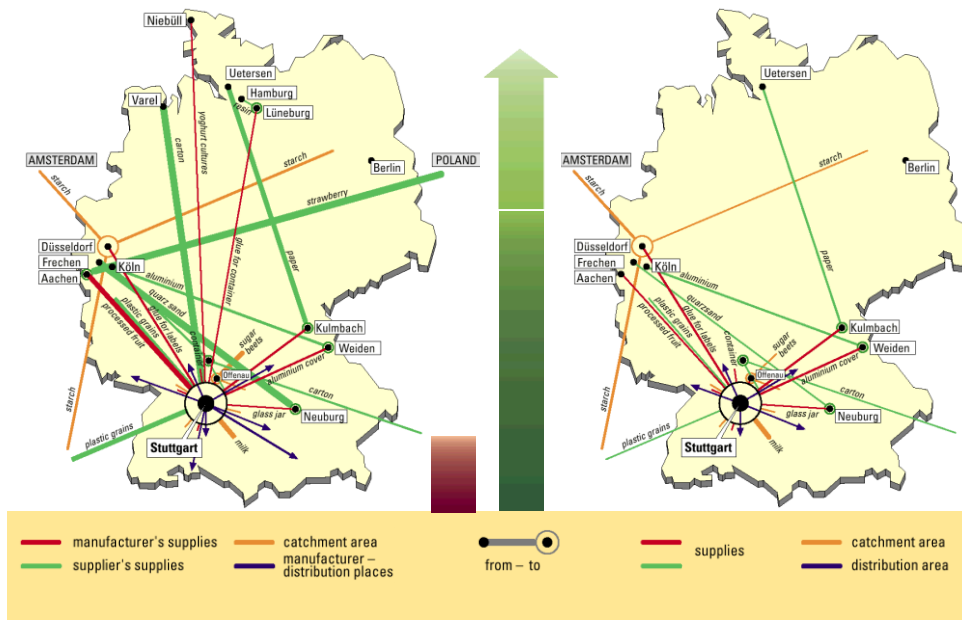
Copenhagen (above)
Freiburg, Vauban (below)

Atlanta is 25 times larger than Barcelona, - with less inhabitants !

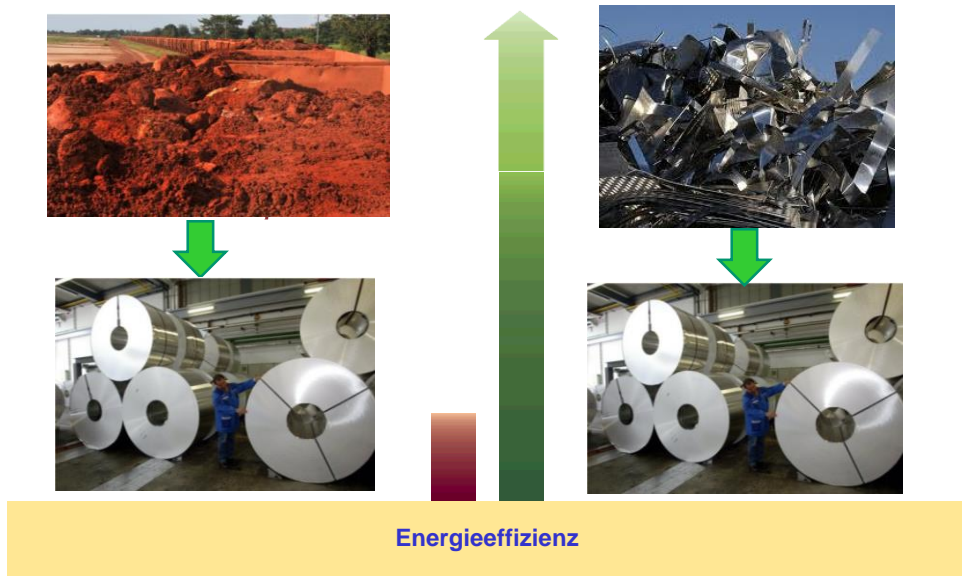


Courtesy Geoffrey Heal

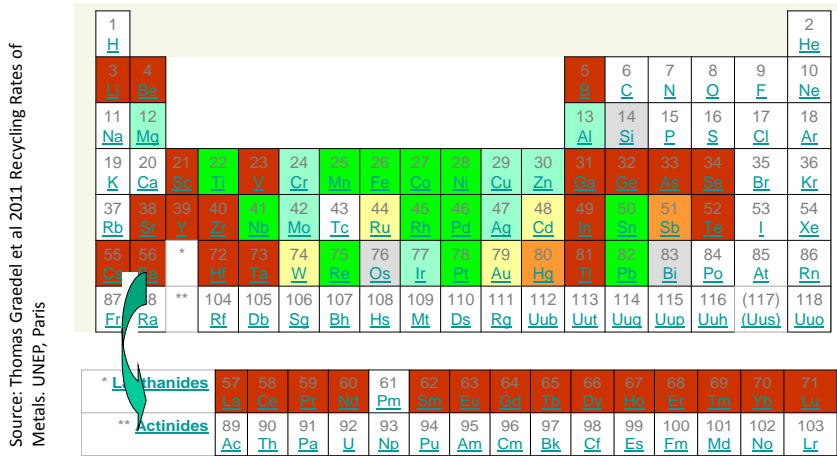
Strawberry yoghurt logistics, mad or reasonable



Aluminium from bauxite or from scrap



A different story: the deplorably low recycling rates of metals, chiefly of high tech metals!



■ >50%
 ■ >25-50%
 ■ >10-25%
 ■ 1-10%
 ■ <1%
 ■ ???

A new, 2013, report is on Metal Recycling Opportunities, Limits, Infrastructure.



... proposing to start with the design of products to facilitate later recycling or remanufacturing.

We hope also to get a remanufacturing report!



www.unep.fr/iscpl/panel

**To sum up this brief story
about efficiency:**

Potentials are absolutely huge!

But much of it remains sleeping!

...leading us into policy questions.

Basically we have 3 options:

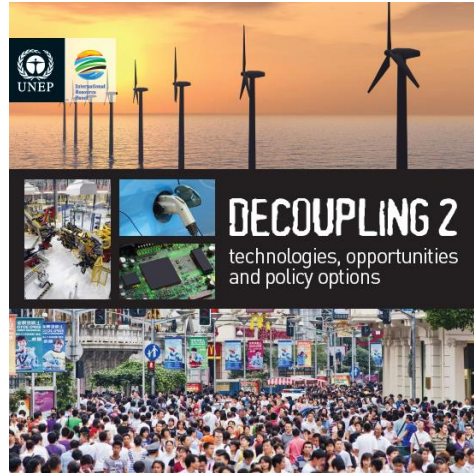
Command and control <including bans, focusing mostly
on toxicity>

Tradable permits <worked for some air pollutants, water
extraction, land use, but not so well on CO₂>

Direct pricing <the underestimated, sleeping giant>

Actually, the newest report of the International Resource Panel, is addressing the policy questions of Decoupling including direct pricing.

The Report was launched on 5th June during the EU's Green Week 2014.



My preference relating to resource efficiency is direct pricing.

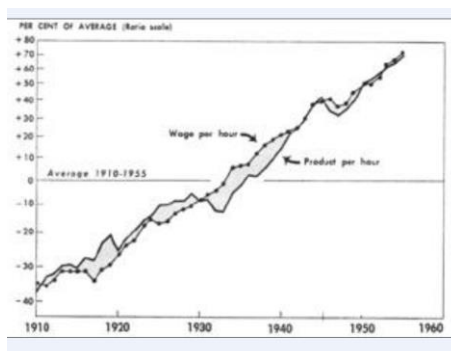
But we must avoid capital destruction, industry emigration, and social injustice.

Make energy and resource prices rise slowly, in proportion to the documented average efficiency increases .

What I am suggesting
is a ping-pong,
similar to the one we
had in the Industrial
Revolution



Labour productivity rose roughly twentyfold in 150
years, - and so did wages!



Example from the USA from 1910 – 1960 showing how
wages followed labour productivity

The new „resource ping-pong“ could cause a steady increase, perhaps five-fold, of average resource productivity, in 40 years.

Two corrections:

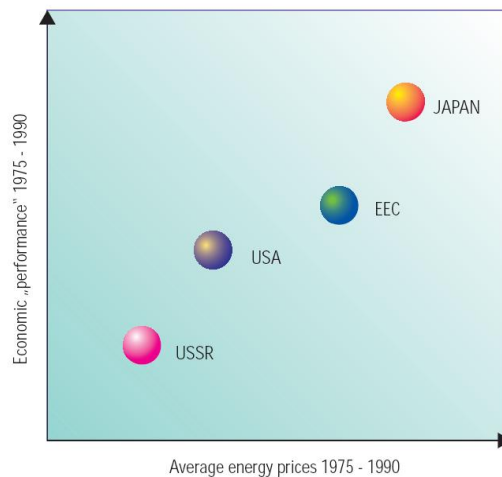
- 1. Life-line tariffs for the poor;**
- 2. Revenue neutrality for endangered branches:
like with the Swedish NOx tax of 1992.**

Where are the winners and where are the losers of the pricing instrument?

Winners: High tech industry; crafts; maintenance and recycling; science and education; city shops; - and future generations!

Losers: freight transport, aircrafts; energy intensive industries (unless they are ,protected'); long-distance commuting.

High energy prices need not hurt the economy. Japan blossomed during the 15 years of highest energy prices!



Clearly, I am not expecting the paradigm shift to happen very soon.

But if pioneering countries and companies enjoy first mover advantages, the others will follow.

Thank you!